# MA Stretch Appendix and Building Energy Codes

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# Green Communities Act (GCA)

- GCA - 2008 Energy legislation in MA
- Adopts latest IECC building energy code
  - Plus other energy measures
  - Building commisioning
  - Building code training

- Creates Green Communities Program

IECC = International Energy Conservation Code – of International Codes Council (ICC)

# Green Communities Program

- $10m/year in funding to towns & cities
- 5 requirements include life-cycle building energy efficiency
- The Stretch code is a practical way to demonstrate life-cycle energy efficiency
  - Built on energy cost-effectiveness modeling
  - Building science-based
  - Building specific life-cycle analysis would be complex to administer

# BUILDING CODE 101

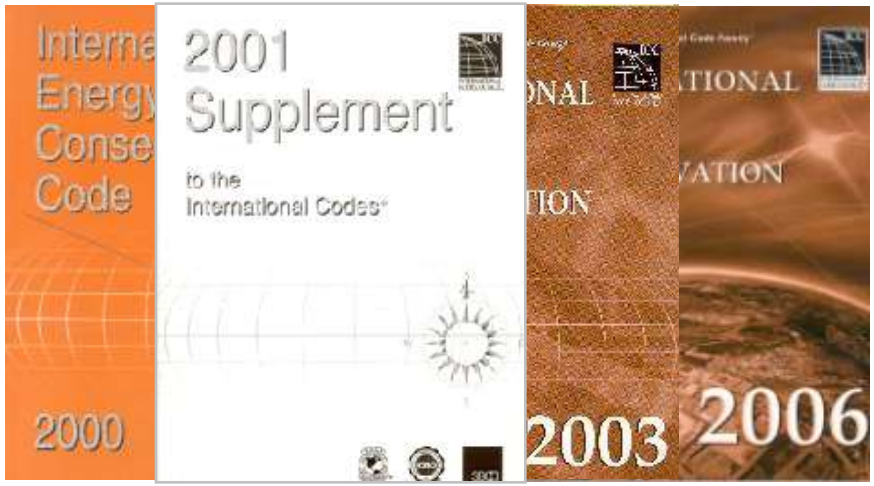
# IECC and ASHRAE Codes

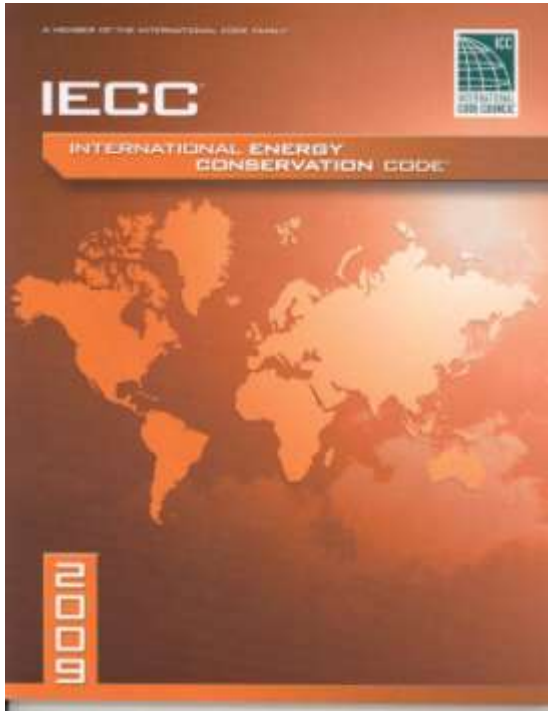
- ICC & ASHRAE develop model building codes and standards for the US.
- ICC: publishes IECC energy code
  - 3 year cycle IECC 2006, IECC 2009
- ASHRAE: publishes 90.1 standard
  - 3 year cycle 90.1-2007, 90.1-2010

IECC = International Energy Conservation Code – of International Codes Council (ICC)

ASHRAE = American Society of Heating, Refrigerating and Air-Conditioning Engineers

# The ICC Family of I-Codes

# IECC and ASHRAE Codes in MA

- MA 6th edition until 2008 – unique to MA
- MA 7th edition: IECC 2006/07 and ASHRAE 90.1-2007 for energy code
- MA 8th edition: 2009 'I' Codes: IBC, IMC, IEBC and IECC as the energy code begins in 2010
  - Note: The IECC allows ASHRAE 90.1 as an alternative compliance path for commercial buildings

ASHRAE 90.1 = *Energy Standard for Buildings Except Low-Rise Residential Buildings*

# IECC 2009 and Stretch code


- MA will have IECC 2009 energy code with Stretch code option.
- Stretch code is an appendix to IECC
- Stretch code uses real-world testing to ensure residential energy savings, and energy modeling to ensure commercial energy savings
- Subsidies help off-set some incremental costs

# RESIDENTIAL STRETCH CODE

# Many ways to meet code

| *Base Energy Code - IECC 2009* | | | |
|---|---|---|---|
| ***Performance*** | ***Performance with HERs rating*** | ***Prescriptive with trade-offs*** | ***Prescriptive*** |
| IECC Chapter 4 section 405 | HERS rating 100 or lower | REScheck (based on IECC Ch. 4) | IECC Chapter 4 |

| *Stretch Energy Code – Appendix 120.AA* | | |
|---|---|---|
| ***Construction Type*** | ***Performance*** | ***Prescriptive*** |
| New Homes | HERS (65 or 70) | N/A |
| Additions | HERS (65 or 70) | Energy Star Homes<br>Builders Option Package (BOP) |
| Renovations | HERS (80 or 85) | Energy Star Homes<br>Builders Option Package (BOP) |

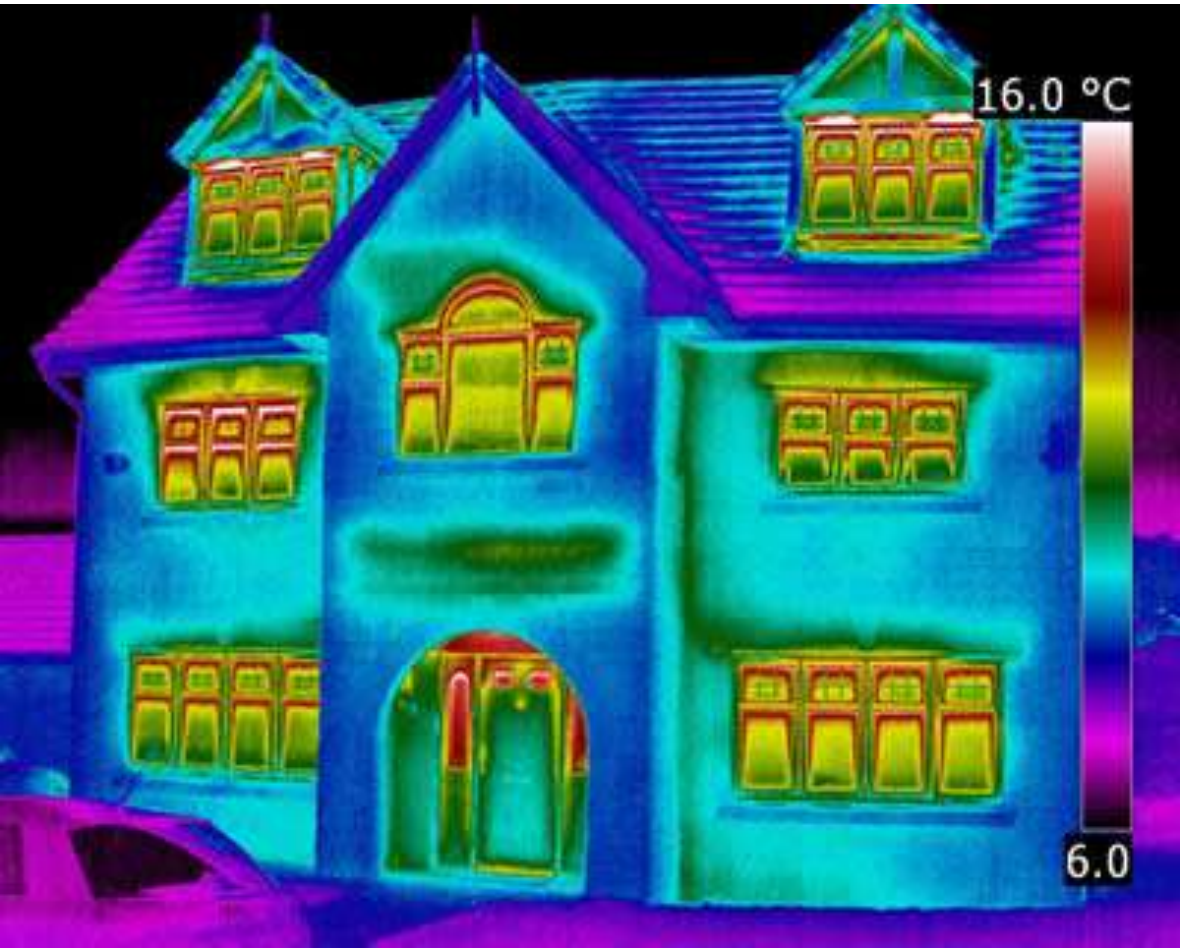
# Why test Performance?


Image source: Environmental Protection Agency

Prescriptive codes don't guarantee good installation, air and water tightness, or that thermal insulation is effective.

(small air gaps can reduce insulation R-values by 50% or more)

# Why test Performance?




Design, Installation & Equipment all important.

- Blower-door test for air leakage
- Infra-red camera tests thermal barrier install.
- Duct test for heating & AC

Image source: http://www.pixelthermographics.co.uk/images/FrontJoinedIR.jpg

# Residential New Construction

- Performance only ‘stretch’ option
  - Uses Home Energy Rating System (HERS)
  - 70 or less < 3,000 sq ft.
  - 65 or less > 3,000 sq ft.
- Requires a certified HERS rater
  - Review building plans
  - Check insulation installation
  - Blower-door and duct testing
  - Thermal bypass Checklist

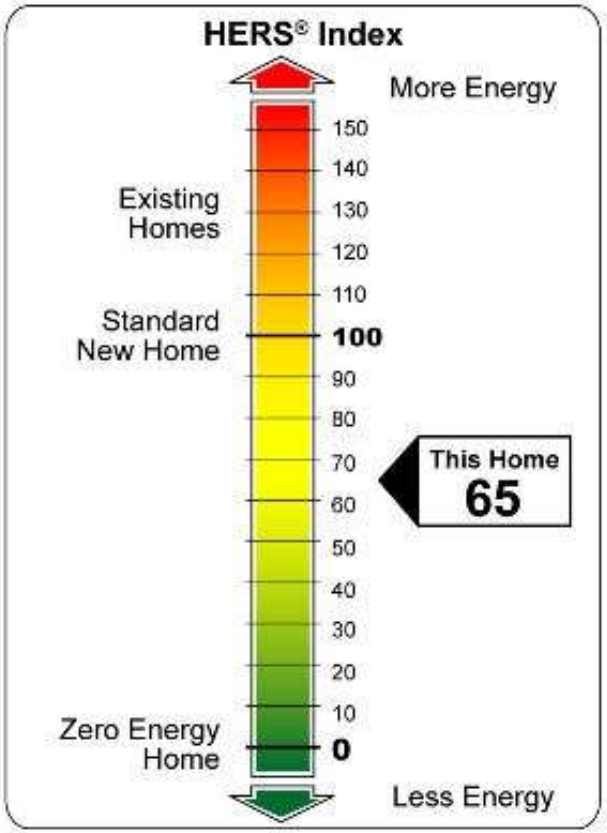



Image source: www.lexingtoninfrared.com/hers-ratings.php

# Residential Additions

- 2 options – Performance or Prescriptive
  - HERS index on just addition (often not possible) or whole house
  - Treated as new construction
  - 70 or less < 3,000 sq ft.
  - 65 or less > 3,000 sq ft.


- Most Additions will use Prescriptive Path
  - Energy Star Builders Option Package (BOP)
  - Includes Thermal Bypass Checklist

# Residential Renovations

- Two options similar to additions
  - Performance HERS option (mostly gut-renovations)
  - 85 or less < 2,000 sq ft.
  - 80 or less > 2,000 sq ft.
- Prescriptive Energy Star
  - Energy Star for homes Builders Option Package
  - Requires Thermal Bypass Checklist



Image source: http://www.wilkinsonbuild.co.uk/Portals/5/Renovation/renovation2.jpg

# ENERGY STAR Qualified Homes
# National Builder Option Package

**The requirements for the ENERGY STAR Builder Option Package (BOP) are specified in the table below.**
To qualify as ENERGY STAR using this BOP, a home must meet the requirements specified, be verified and field-tested in accordance with the HERS Standards by a RESNET-accredited Provider, and meet all applicable codes.

| | **Hot Climates** [1] (2004 IRC Climate Zones 1,2,3) | **Mixed and Cold Climates** [1] (2004 IRC Climate Zones 4,5,6,7,8) |
|---|---|---|
| **Cooling Equipment** (Where Provided) | Right-Sized [2]:<br>• ENERGY STAR qualified A/C *(14.5 SEER / 12 EER)*; OR<br>• ENERGY STAR qualified heat pump [3] *(14.5 SEER / 12 EER / 8.2 HSPF)* | Right-Sized [2]:<br>• 13 SEER A/C; OR<br>• ENERGY STAR qualified heat pump [3] *(14.5 SEER / 12 EER / 8.5 HSPF)* |
| **Heating Equipment** | • 80 AFUE gas furnace; OR<br>• ENERGY STAR qualified heat pump [2, 3] *(14.5 SEER / 12 EER / 8.2 HSPF)*; OR<br>• 80 AFUE boiler; OR<br>• 80 AFUE oil furnace | • ENERGY STAR qualified gas furnace *(90 AFUE)*; OR<br>• ENERGY STAR qualified heat pump [2, 3] *(See Note 3 for specifications)*; OR<br>• ENERGY STAR qualified boiler *(85 AFUE)*; OR<br>• ENERGY STAR qualified oil furnace *(85 AFUE)* |
| **Thermostat** [3] | ENERGY STAR qualified thermostat (except for zones with radiant heat) | |
| **Ductwork** | Leakage [4]: ≤ 4 cfm to outdoors / 100 sq. ft.; AND<br>R-6 min. insulation on ducts in unconditioned spaces [5] | |
| **Envelope** | • Infiltration [6,7] (ACH50): 7 in CZ's 1-2 \| 6 in CZ's 3-4 \| 5 in CZ's 5-7 \| 4 in CZ 8; AND<br>• Insulation levels that meet or exceed the 2004 IRC [8]; AND | |

# ENERGY STAR Qualified Homes
# Thermal Bypass Inspection Checklist

Home Address:_____ City:_____ State:_____

| Thermal Bypass | Inspection Guidelines | Corrections Needed | Builder Verified | Rater Verified | N/A |
|---|---|---|---|---|---|
| 1. Overall Air Barrier and Thermal Barrier Alignment | **Requirements:** Insulation shall be installed in full contact with sealed interior and exterior air barrier except for alternate to interior air barrier under item no. 2 *(Walls Adjoining Exterior Walls or Unconditioned Spaces)* | | | | |
| | **All Climate Zones:** | | | | |
| | 1.1 Overall Alignment Throughout Home | ☐ | ☐ | ☐ | ☐ |
| | 1.2 Garage Band Joist Air Barrier (at bays adjoining conditioned space) | ☐ | ☐ | ☐ | ☐ |
| | 1.3 Attic Eave Baffles Where Vents/Leakage Exist | ☐ | ☐ | ☐ | ☐ |
| | **Only at Climate Zones 4 and Higher:** | | | | |
| | 1.4 Slab-edge Insulation (A maximum of 25% of the slab edge may be uninsulated in Climate Zones 4 and 5.) | ☐ | ☐ | ☐ | ☐ |
| | **Best Practices Encouraged, Not Req'd.:** | | | | |
| | 1.5 Air Barrier At All Band Joists (Climate Zones 4 and higher) | ☐ | ☐ | ☐ | ☐ |
| | 1.6 Minimize Thermal Bridging (e.g., OVE framing, SIPs, ICFs) | ☐ | ☐ | ☐ | ☐ |
| 2. Walls Adjoining Exterior Walls or Unconditioned Spaces | **Requirements:**<br>• Fully insulated wall aligned with air barrier at both interior and exterior, **OR**<br>• Alternate for **Climate Zones 1 thru 3**, sealed exterior air barrier aligned with RESNET Grade 1 insulation fully supported<br>• Continuous top and bottom plates or sealed blocking | | | | |
| | 2.1 Wall Behind Shower/Tub | ☐ | ☐ | ☐ | ☐ |
| | 2.2 Wall Behind Fireplace | ☐ | ☐ | ☐ | ☐ |
| | 2.3 Insulated Attic Slopes/Walls | ☐ | ☐ | ☐ | ☐ |
| | 2.4 Attic Knee Walls | ☐ | ☐ | ☐ | ☐ |
| | 2.5 Skylight Shaft Walls | ☐ | ☐ | ☐ | ☐ |
| | 2.6 Wall Adjoining Porch Roof | ☐ | ☐ | ☐ | ☐ |
| | 2.7 Staircase Walls | ☐ | ☐ | ☐ | ☐ |
| | 2.8 Double Walls | ☐ | ☐ | ☐ | ☐ |

# ‘Stretch Code’ and ‘Energy Star’

- The Stretch appendix puts the current Energy Star Homes program into code (at Tier 2 level)
- All new residential construction can use the Energy Star homes program to receive:
  - Builder incentives/rebates
    - $1250/home for HERS 65
    - other utility incentives – on appliances, flourescent lights, etc.
  - Builder training and materials
  - Subsidized HERS raters

# COMMERCIAL STRETCH CODE

# Commercial 'Stretch' Appendix

- Only for New Construction over 5,000 $ft^2$
  - New Buildings or Building additions
- Performance option for all Buildings
  - 20% below ASHRAE 90.1-2007
- Prescriptive option for most building types
  - 5,000 - 100,000 $ft^2$
- Exemptions (comply with base code)
  - Commercial buildings smaller than 5,000 $ft^2$
  - Special cases smaller than 40,000 $ft^2$
  - Commercial renovations and existing interior fit-outs

# Commercial 'Stretch' options by building size/type

- Over 100,000 $ft^2$ - Only Performance option
  - Energy model showing 20% below ASHRAE 90.1-2007
- 5,000-100,000 $ft^2$ – Performance or Prescriptive
  - 20% below ASHRAE or
  - Stretch code amendments to IECC Chapter 5
- Special cases – buildings with unusual energy demands
  - Supermarkets, Labs, Warehouses
  - Over 40,000 $ft^2$ - 20% below ASHRAE 90.1-2007

# Commercial Base and Stretch code

- Performance option is 20% better than base code i.e. ASHRAE 90.1-2007
  - Modeling is common to most commercial new construction (same as LEED, MEPA requirements )
- Prescriptive option is a revised IECC Ch.5 based on utility supported 'Core Performance' program
- Utility program & incentives to help
- Prescriptive option includes 3 choices
  - Heating and cooling equipment improvements,
  - Improved Lighting efficiency (LPD)
  - 3% + of electric needs from on-site renewables

# MUNICIPAL ROLE IN STRETCH CODE

# Adoption by Towns and Cities

- Adoption Process requirements
  - Municipal public hearing
  - Vote of Board of Selectmen or City Manager, Mayor and City Council
- Timing of Adoption
  - Muni vote any time
  - Code change starts on following Jan 1 or Jul 1
  - Base & Stretch code both in place for 1st 6 months



Image source: http://www.zechallenge.com/StephensClark-update.htm

# Implementation Timeline example

- Example of adoption by Town of Canterburg, MA
  - Oct 12, 2009 - Municipal public hearing
  - Nov 3, 2009 - Vote of Board of Selectmen to adopt Stretch (Canterburg becomes a Green Community)
- Timing of code implementation in Canterburg
  - Jan 1, 2010 Stretch code implemented alongside base code in Canterburg
  - Jan – Jul 2010 Building permits can comply with either base code (IECC 2009) or Stretch until July 1, 2010
  - Jul 1, 2010 Stretch code becomes sole energy code in Canterburg – for new building permits

# Help with ‘Stretch’ Adoption

- Green Communities Program – Tech. Assistance
  - Consultants with good code/energy star experience
  - Regional staff trained on the stretch code
  - Other towns/cities considering adoption
  - Involve code officials and buildings community
  - FAQ on DOER Green Communities website

# Incentives available

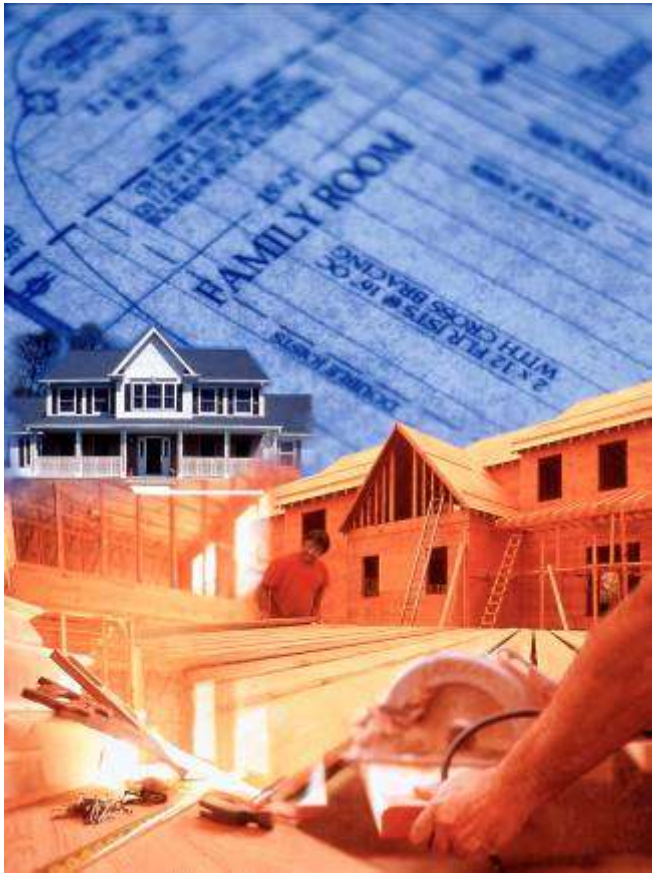
- Towns/Cities – Green Communities Program
  - Technical assistance available now
  - Larger grant round out soon
- Builders – Energy Star & Utility Programs
  - ICF – Residential
  - Utility - Commercial
  - Federal $2k/unit residential tax credit



Image source: http://www.transformations-inc.us/zero-energy-homes.html

# Code Compliance & Inspections

- Essentially the same as base code
- Code Official has same final authority
  - Same building inspections
  - Approves HERs rating or ASHRAE modeling as documentation of energy
- Certificate is required



# Stretch appendix http://tiny.cc/8xbBo

The Official Website of the Executive Office of Public Safety and Security (EOPSS)

Public Safety

EOPSS Home | Mass.Gov | State Agencies | State Online Services

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Home > Public Safety Agencies > Massachusetts Department of Public Safety >

## Energy Conservation 'Appendix 120 AA' Approved

A code change proposal relating to energy conservation was approved by the BBRS at the May 12, 2009 meeting and will become an appendix to the MA State Building Code (780 CMR ) on or about August 1, 2009. It is based on the *International Energy Conservation Code (IECC) 2009* and can be viewed by following the 1st link below. The 2nd link will take you to a two-page overview of this new appendix.

This appendix may be adopted by any municipality in the commonwealth, by decision of its governing body. In a city having a Plan D or Plan E charter the governing body shall be the city manager and the city council, and in any other city the mayor and city council. In towns the governing body shall be the board of selectmen. In order to be adopted, the appendix must be considered at an appropriate municipal public hearing, subject to the municipality's existing public notice provisions. If adopted by a municipality this appendix rather than 780 CMR 13, 34, 61, or 93, as applicable, shall govern.

Also at the May 12 meeting a concurrency period and a training policy were approved. Concurrency period is a period when *either* the new code *or* the existing code can be used but *not comingled*. The BBRS approved a concurrency period of 6 months to a maximum of 12 months, with such period to begin on either January 1 or July 1 of any year. In addition a town or city which adopts the appendix must provide training to the building official prior to the start of the concurrency period. If you have comment or questions on this subject please forward them to mike.quigli@state.ma.us

Appendix 120 AA July 9, 2009 Final PDF (270kb)

Stretch Code Overview June 5, 2009 PDF (66kb)

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# Frequently Asked Questions

- Cost of stretch code homes
- Stretch and utility incentives
- Stretch and training on codes
- Availability of HERs raters
- Availability of blower door equipment
- Stretch and triggering code – can I keep my windows?
- Stretch and historic buildings
- Stretch and LEED compatibility

# Cost of Stretch code

- Based on analysis of what is cost effective and what is already being built in the voluntary market
  - Energy star 15% of all MA new residential in 2008

- 2 examples both show clear $$ savings
  - New 3-bed 2,700 $ft^2$ ranch
  - Rehab. urban triple-decker – 3x 1,400 $ft^2$ units

# Example of Benefit-Cost Modeling: 2,672 square foot, 3-bedroom home

| **Task A – New Home** | |
|---|---|
| HERS Index Modeled in REM/Rate | **60** (energy use 40% below 2006 IECC code) |
| Improvement Measures (changes relative to base case) | - Conditioned basement<br>- Foundation Walls R10 insulation<br>- Above grade walls R22 insulation<br>- Window U-factor .33<br>- Attic ceiling R38 cellulose insulation<br>- Slope ceiling R32 cellulose insulation<br>- Infiltration 4 ACH50<br>- Natural Gas Furnace 94 AFUE, 65kBtuh<br>- Central Air Conditioner 3 ton 15 SEER<br>- Domestic Hot Water .62 natural gas tank<br>- Programmable thermostat<br>- 75% Fluorescent lighting |
| | |
| Improvement Costs | $ 8,103 |
| Mortgage Interest Rate | 5% |
| Loan Term (Years) | 30 |
| Annual Incremental Mortgage Payment | $527 |
| Annual Energy Costs | $ 3,103 |
| Annual Energy Savings from Baseline | $1,364 |
| **Annual Cash Flow Gain** | **$ 837** |

Note: This does not include the cost of a HERS rater (est. $500-1200) or the savings from utility rebates and Federal Tax Credits (up to $4000).

# Stretch code and utility incentives

- Stretch code based on existing Utility sponsored voluntary market
  - Energy star for residential homes up to 5 stories
  - NBI Core Performance for Commercial Buildings
    - Core Performance modeling the basis of Commercial Stretch chapter 5
    - NBI & consultant team drafted Stretch language

# Stretch and training on codes

- Offering free energy code training (on IECC 09 and stretch code) with materials to all MA code officials
- Anyone else can attend the training, and pay small fee to cover costs
- State Code training out to bid (Wed Aug 19th) and will start this year (Nov 09)
- Energy star homes training available for free through ICF International: www.energystarhomes.com/
- Utilities also sponsor commercial 'Core Performance' energy code training

# Availability of HERs raters

- HERs raters needed for all new residential homes in stretch communities
- Current HERs raters are handling 15% of MA housing without a problem
- MA adding a new HERs provider to give new HERs raters more options
- MA housing starts are down, and most starts are not in likely 'stretch code' communities.
- Longer term, MA funding workforce development training at 5 Community colleges
- Expect HERs raters will arrive to meet the demand

# Availability of blower door equipment

- Blower door tests needed for all new residential in stretch communities
- MA adding to growing demand for this equipment in US
- Stretch code not taking effect in any city or town until July 2010 or later
- Don’t anticipate a problem

Image source: http://www.expert-air-purifier-reviews.com/images/blower-door.gif

# Stretch and ‘triggering code’

- Code triggers are essentially the same in base and stretch code communities
- Code requirements only apply to systems being altered in renovations/repairs
- That means if you are changing your windows you need code-compliant new windows
- But if you are changing your heating system you can keep your old windows
- Replacing broken windows or storm windows does not trigger code
- All exceptions listed on stretch code page 1

# ‘Stretch’ & Historic Buildings

- Listed historic buildings are exempt from building energy code requirements.
- The stretch code is no different
- You may still get lots of questions…
  - Building code officials likely know the answer in your community

# Commercial ‘Stretch’ & LEED(v.3)

- LEED and Commercial ‘Stretch’ code are totally compatible
  - Both use ASHRAE 90.1-2007 as the energy modeling baseline.
- LEED energy model = Stretch energy model

  20% better than ASHRAE 90.1-2007= 5 LEED energy modeling points
- LEED also has non-energy requirements

# Residential 'Stretch' & LEED for Homes

- LEED for Homes and 'Stretch' code are highly compatible
  - Both use HERS rating as the energy modeling system.
- LEED for homes min. requirement
  - EA1 – Performance of Energy Star for Homes
  - Either HERS 85 or better or Energy Star BOP
  - Thermal bypass checklist
- LEED for homes also has substantial non-energy requirements

# Questions ?

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Image source: Wisdom Way Solar Village – Greenfield, MA: http://www.ruraldevelopmentinc.org/WWSV/wwsv_update_current.htm